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The New Awakening

Symposium of Official Opinion

In the last 20 years, the human race has increased by some 700 million. In the next 20 years, well over one billion people will be added if today's growth rates continue.

This rapid growth is without precedent, and it cannot be maintained indefinitely. Economic, social and political deterioration would reduce low living levels, and this eventually would result in rising death rates. In this technological age, such a Malthusian check on population growth would be a cruel solution to the problem.

The alternative to such a chaotic prospect is application of scientific knowledge to regulate fertility. Certainly that is the humanitarian approach to the problem.

Today's rapid increase in population growth is due largely to the application of science to deferring death. Because there has not been a concomitant attack on the birth rate, population growth has become one of the gravest dilemmas of the time.

The attack on disease and early death, one of humanity's greatest achievements, is supported by the instinct of self-preservation. Hence it has met little opposition through the centuries. It is accepted because it is *good* for humanity. Those who pioneered the attack could not foresee the dangerous "side effect" — too-rapid population growth — which now is engulfing whole continents, including some of the most densely settled areas of the world. Growth rates may accelerate during the next two decades as public health programs wage increasingly effective war on more diseases in ever-widening areas.

The humanitarian approach would apply the scientific method, so effective in reducing mortality to an investigation of the physiology of human fertility and to the regulation of fertility in areas where the imbalance between births and deaths has resulted in dangerously rapid population growth.

The humanitarian approach would also create new climates of opinion which would stimulate a

global awakening to the moral necessity of the small-family pattern now that death rates are low. All avenues of communication must be open so that this concept will reach and be accepted by the hundreds of millions of families in the countries where growth is now—or may become—a major hazard. This is aggravated because social isolation, low incomes and illiteracy are serious barriers, particularly in those areas where the problem is greatest.

Social customs which determine cultural patterns are deeply rooted and tenacious. Cultural change now tends to proceed at a snail's pace while population growth increases alarmingly. There is no mystery as to why high fertility has survived and is accepted as "natural" in many societies. For thousands of years, death rates were so brutally high that birth rates near the physiological maximum were needed for survival. But the deeply embedded, ancient mandate to "go forth and multiply" is a dangerous anachronism today.

In some countries where the population problem is acute, recognition that something must be done to check rapid population growth has been building up among government leaders. In recent years, these countries have included Egypt, India, Pakistan and mainland China. But a broader realization is needed to create the political support which will initiate action programs.

In the United States, entrenched inhibitions have prevented recognition and discussion of the population problem. Now these are finally crumbling as a result of realistic but woefully overdue examinations. A new climate of thought is finally emerging.

Recent statements of President Eisenhower reflect this. In a discussion with Prime Minister Macmillan, he said that the problem of the underdeveloped nations is more lasting, more important, to Western civilization than Soviet-Western differences. More recently, the President expressed deep concern over the plight of the millions of people who live in the world's underdeveloped areas. Excerpts of his speech are published in this issue.

The Third Interim Report of the President's Committee to Study the United States Military Assistance Program (the "Draper Committee" report), transmitted to the President on July 13, no doubt paved the way for his firm stand. This is the first time an officially appointed group has recognized the global implication of the population problem. The recommendations included in the Report were strong and clear. The section dealing with the population problem is reproduced in full in this issue.

More recently, a study prepared at the request of the Committee on Foreign Relations of the United States Senate by the Stanford Research Institute stressed the need for finding a solution to the population problem. Excerpts from the Report are included in this issue.

The American Public Health Association, an organization of some 13,000 members, held its annual

meeting in October. The Governing Council approved a policy statement on the population problem which recognized the manifold ways population pressure affects the social and economic welfare of families and nations. The statement, reprinted in this issue, stresses the need for all public health organizations to "give increased attention to the impact of population change on health" and to facilitate regulation of birth "consistent with the creed and mores of the family concerned."

This new awakening may result in a realistic technical aid program available to all who ask for help—a program designed to hit hard at the cancerous problem of too-rapid population growth.

—ROBERT C. COOK, *Editor*.

PRESIDENT EISENHOWER SPEAKS

Excerpts from an address by President Eisenhower at Abilene, Kansas, October 13, 1959

. . . Our parents, like most American parents of the period, were concerned primarily with the cardinal features of their religious philosophy—beliefs which shaped their own lives and their guidance of their children. Love of God, fairness in human relations, independence and responsibility, concern for the welfare of others, and conviction that each free individual could through his own efforts achieve a full life—these were all included in an idea which was as much a part of our home as the food we ate and the clothes we wore.

* * *

"FORCES OF REASON" NEEDED

Factual information must be energized by the force of reason, understanding and interpretation. To the true historian, trends are more important than the recorded deeds of any period. A study of events of the past half century shows that the compelling forces have been at work, causing trends which will carry into decades ahead with persistent momentum.

We need not dwell on the disappearance of physical earth-bound frontiers and the opening of frontiers of outer space; or on the shattering of blissful self-sufficiency and the growth of exacting interdependence; or on the development of power so awesome that nations now have no logical alternative to replace coercion with honest negotiation and cooperation. These and other great changes are obvious, but whether they will lead us to disaster or to an era of hope and accomplishment will depend on the degree of understanding and wisdom we apply in solving a vast array of problems.

Because upon our powerful nation the mantle of free world leadership has fallen, our responsibility in the search for solutions is inescapable. And, since in our country the basic social power is in the hands of all the people, each citizen bears directly a part of the responsibility for a right action.

Each of you here today must help make the fateful decisions of the future. Study of the past and the present will help to assure that these decisions are made wisely.

Think for a moment of the type of decision you will be forced to make in the light of just one obvious trend in the world scene.

POPULATION RISE NOTED

When you of my age were youngsters, William Allen White was disturbed by the fact that Kansas was losing population. What would he say today about the rapid growth of Kansas and the swelling population of the nation?

What would be his reaction to present estimates that while our country's population is increasing to 275 million in the next thirty years, the world's population will be nearly five billion people?

Many peoples of the world, once dominated and submissive, are now and will continue to be involved in a great ferment, explosive in its potential. Everywhere, knowledge and ideas, spread by modern communications, are routing centuries of ignorance and superstition. Peoples now know that poverty and suppression are neither universal nor are they inevitable.

Increasingly and insistently, they are demanding the elimination of the human indignities of starvation, ill-health, and peonage. They want independence, individual freedom and responsible government.

These increasingly numerous periods of tomorrow's world will multiply those wants — and they will have at their disposal both more constructive and more destructive capacity than the world has known before.

DECISIONS TO BE MADE

Now how do you believe this capacity will be used? What decisions will you make in this regard?

These are sobering questions. They deserve your most earnest consideration.

For if the growing power of free men is wisely and skillfully applied toward the common aspirations of humanity, then a world of peace and plenty becomes a high probability.

You know that the free nations of the world have the capacity and can develop the will to overcome together the powerful, perplexing forces which for thousands of years have yielded hate, distrust, poverty.

Humanity's upward climb involves complex economic, educational and political problems, all of which cry for wisdom as we seek solutions, as we search for world understanding.

I cite one homely example.

A common miracle is the telephone. You can speak into it and, with the speed of light, your words will be carried around the world. Yet, even this technological triumph encounters serious impediments to true, free communication among populations. Most people in the world do not have access to a telephone. This is an economic problem. Among those who do, you would not be able to understand many because of language barriers

—an educational problem. And even if these difficulties were surmounted, almost a third of the world's peoples would be forbidden to talk to you—a political problem.

Obviously, a program for peaceful progress calls for intelligent economic, educational and political cooperation: economic cooperation which promises that peoples everywhere may, by concerted effort, conquer hunger and disease, and lift their levels of living; educational cooperation to develop that genuine human understanding on which all other cooperative activity must be based; and political cooperation, not only to settle disputes which continuously arise in an imperfect world, but also to build the social structures that encourage man in his striving for a better life.

* * *

CAPITAL AID FAVORED

Foreign capital helped our own country make spectacular progress during the first three-quarters of the nineteenth century — capital which over a forty-year period we repaid with interest. So, too, can private and public capital, under the right conditions, now assist the less-developed nations make sound progress toward the achievement of their goals. Those "right conditions" must include both an honorable and responsible attitude within the nations needing the capital and intelligent trade relations among all free nations.

No other aspiration dominates my own being so much as this: That the nations of East and West will find dependable, self-guaranteeing methods to reduce the vast and essentially wasteful expenditures for armaments, so that part of the savings may be used in a comprehensive and effective effort for world improvement.

As the less developed nations succeed in establishing viable economies and raising their living standards, our own economy will soar to new heights and our technology will be challenged as never before. Burdensome surpluses—even those of wheat—will disappear. Indeed, the world may then be threatened with very real deficits—of food, energy, minerals. Enlarged demand throughout the world will have to be met by new methods, and more effective use of resources everywhere.

The world must learn to work together—or finally it will not work at all.

AN IMMEDIATE PROBLEM

This is not a problem for the distant future. Within the lifetime of many of you here today the global population will be five billion. You must now help determine how such a vast humanity may, in freedom, achieve stupendous increases in economic output, and increase the sum of human happiness on this earth.

The task ahead is not for the faint-hearted.

But does anyone of central Kansas need to be told that our parents and grandparents who first worked this black soil were not faint-hearted? They had faith—faith in the religious concepts that dominated their beings, faith in the vir-

tue and success of their own labor, faith in their neighbors and in the inexhaustible potential of free men.

If they were here today, they would, I'm sure, wonder whether we possess for our time, as they did for theirs, a comprehension of the concepts and basic principles which, universally applied, can lead mankind toward a world community of free nations, characterized by peace and by justice. . . .

ECONOMIC ASSISTANCE PROGRAMS AND ADMINISTRATION

SECTION V—THE POPULATION QUESTION*

No realistic discussion of economic development can fail to note that development efforts in many areas of the world are being offset by increasingly rapid population growth.

In 1950 the world population was estimated to be about 2.5 billion. This represented an increase of approximately one billion in the previous fifty years. If present growth rates continue, there would be a further increase of nearly four billion in the second half of the 20th century. This would more than double the 1959 population of the world within the next forty years—a period much shorter than the life expectancy of those just now reaching voting age. Problems connected with world population growth will be among the most serious to be faced by the younger generation of today.

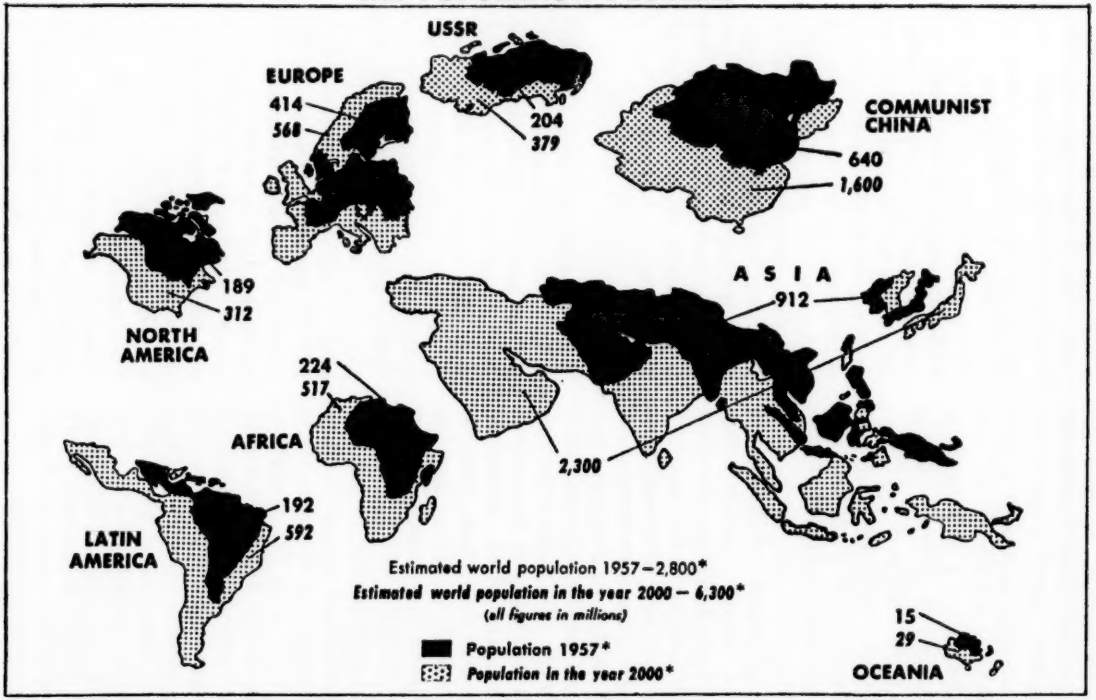
A large part of the world population is at present underfed. The United Nations estimates that from 1950 to 1955 the world's population increased at an annual rate of one and one-half per cent, with the population in many underdeveloped countries increasing at double this rate. World food production is barely keeping pace with the increase in population in the world. However, the increase in food production in most of the underdeveloped countries has been falling behind the increase in population.

The seriousness of this problem is increased by the fact that the major population growth is taking place in the economically underdeveloped areas, where annual rates of three per cent growth are not uncommon. Unless the relationship between the present trends of population growth and food production is reversed, the already difficult task of economic development will become a practical impossibility.

The present rapid rates of population growth result primarily from a decrease in mortality rates rather than from a marked increase in fertility rates. Public health cam-

*Reproduced in full from the Third Interim Report of the President's Committee to Study the United States Military Assistance Program, transmitted to the President July 13, 1959, and transmitted by him to the Congress of the United States.

THE POPULATION PROBLEM*



All statistics based on public sources; size of areas proportional to estimated populations. Estimates for the year 2000 based on United Nations "medium asumptions" for birth and death rates. Computations based on the U.N. projections result in estimated average rates of annual population increase per area as follows: Europe, 0.7%; North America, 1.2%; USSR, 1.4%; Oceania, 1.5%; Africa, 1.8%; Communist China, 2.1%; Asia, 2.1%; Latin America, 2.7%.

paigns, especially in the less developed areas, have been phenomenally successful in many countries. In some instances, death rates have been cut by as much as 30 per cent in a single year and 50 per cent in the short span of 10 years. This is a great humanitarian achievement. Nevertheless, continuation of the traditionally high fertility rates meanwhile results in rapid population growth.

Although experience in the more developed countries suggests that present high fertility rates may eventually fall more into line with the decreased mortality rates, these high fertility rates are normally a part of deeply rooted cultural patterns, and natural changes occur only slowly. In many countries, national production is failing even to keep pace with population growth, and per capita gross national product and food supplies are therefore decreasing rather than increasing.

Government leaders in many of the less developed nations recognize that the only hope for their people lies in accelerating the normal adjustment to the rapidly declining mortality rate. Few countries have set up the necessary programs, although broad acceptance has been found in those areas where programs have been established. Most of the countries lack the large numbers of trained social and public health workers needed to implement an effective program.

Basically, the problems of rapid population growth and of adequate economic progress must be faced and solved by the individual countries. The United States and the other more advanced countries can and should be prepared to respond to requests for information and technical assistance in connection with population growth. Such information will help to point up the seriousness of the problem, and to encourage action in countries where population pressures exist. Such information is also useful in defining the areas in which initial efforts will be most effective. Recognizing an immediate problem created by the rapid growth, the United States should also increase its assistance to local programs relating to maternal and child welfare.

We Recommend: That, in order to meet more effectively the problems of economic development, the United States (1) assist those countries with which it is cooperating in economic aid programs, on request, in the formulation of their plans designed to deal with the problem of rapid population growth, (2) increase its assistance to local programs relating to maternal and child welfare in recognition of the immediate problem created by rapid population growth, and (3) strongly support studies and appropriate research as a part of its own Mutual Security Program, within the United Nations and elsewhere, leading to the availability of relevant information in a form most useful to individual countries in the formulation of practical programs to meet the serious challenge posed by rapidly expanding populations.

UNITED STATES FOREIGN POLICY

Possible Nonmilitary Scientific Developments and Their Protential Impact on Foreign Policy Problems of the United States

CHAPTER 3: POPULATION, FOOD, AND SCIENCE*

A rapidly increasing population within a finite world creates long-range and short-range problems for foreign policy. In some parts of the world, food shortages and population pressures are already contributing to conditions that can lead to social unrest and war. This chapter examines the contributions that science and technology may make to the solution of these problems.

A. POPULATION PRESSURES

In the last few years there has been a sudden, radical spurt in the rate of world population growth. As shown in Table I, the rate has been accelerating for a long time, but the increase in this rate during the 5 years 1950-55 was greater than the increase in the 50 years 1900-50.

The most comprehensive analysis of future world population growth has been undertaken by the United Nations Bureau of Social Affairs. The latest estimates, based on medium assumptions concerning future trends in birth and death rates, are shown in Table II.

These estimates indicate that world population may increase by 53 percent between 1950 and 1975, and by 64 percent between 1975 and 2000, thus doubling in less than 50 years. During 1950-75, the population of Latin America may increase by 86 percent, Asia by 60 percent, Oceania by 59 percent, Africa by 52 percent, Northern America by 43 percent, and Europe (including the U.S.S.R.) by 31 percent.

The causes of the growth in world population during the last several centuries are many. Among them are the opening for settlement of sparsely populated lands in the Americas and elsewhere, improved transportation, the progress in agriculture and industry, the expansion of trade, more effective preservation of public order, and—

TABLE I. RISING RATES OF GROWTH IN WORLD POPULATION

Year	World population (millions)	Average annual percent rise in prior period	Years to double at this rate
1800	906	.....	.....
1850	1,171	.53	135
1900	1,608	.64	110
1950	2,476	1.04	67
1955	2,691	1.68	42

Source: Kingsley Davis, "The World's Population Explosion," in James Daniel (edition), "Private Investment: The Key to International Industrial Development," New York, McGraw-Hill, 1958, p. 18.

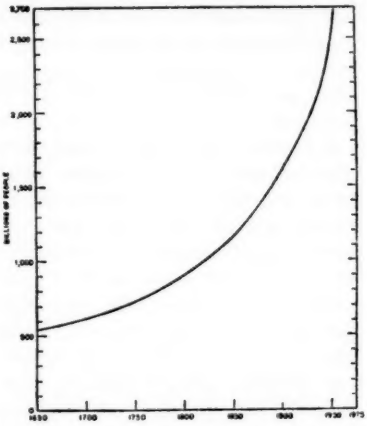
*Reproduced with minor deletions from a Study prepared at the request of the Committee on Foreign Relations of the United States Senate by Stanford Research Institute (Pursuant to S. Res. 336, 85th Congress, and S. Res. 31, 86th Congress).

especially in the 20th century—the spread of improved medical and public health measures.

The remarkable insecticidal properties of DDT, discovered by a Swiss chemist in 1939, led to the development of a large family of powerful new chemical and biological weapons against disease-carrying insects. Equally important have been the advances in the social technology for making use of the new weapons. For example, the Rockefeller Foundation, the World Health Organization, and national health agencies have devised and demonstrated ways to eradicate malarial mosquitoes from large areas within a few years. The sudden drop in the death rate in Ceylon after 1946 [15] is ascribed to such an antimalaria campaign and to other public health measures. The high birth rate remained unaffected, and an explosive increase in population growth was immediately underway. Ceylon's experience is by no means unique.

A situation truly unprecedented in human history has thus been created. It is now possible, by fairly inexpensive and simple public health techniques, to drop the death rate to low "modern" levels without first raising the economic productivity of a "traditional" society. Whereas in the Western world the population growth of modern times followed economic development, in many underdeveloped countries today a very rapid population growth is preceding economic development.

WORLD POPULATION, 1650-1955



Source: W. S. and E. S. Woytinsky, *World Population and Production*, New York, Twentieth Century Fund, 1953, p. 34. United Nations Demographic Yearbook, 1956.

Some of the countries where population explosions are taking place are already very densely peopled. Population growth rates of 2 or 3 percent a year, quite common in underdeveloped countries now, are a heavy handicap in the struggle of these countries to provide more food, clothing, and education per person. In India, for example, the present growth rate of 2 percent means a net addition of 8 million persons each year, rising soon to 10 million each year. The additional population in each decade, assuming no change in rate, will amount

[15] The death rate from malaria dramatically dropped in Ceylon from about 160 per 100,000 in 1945-46 to 56 per 100,000 in 1947-48 and 2.3 per 100,000 in 1955-56. Similarly, the general death rate dropped from about 20 per 1,000 in 1945-46 to 13.5 per 1,000 in 1947-48 to 9.8 per 1,000 in 1956. See N. K. Sarkar, "The Demography of Ceylon," Government Press, Ceylon, 1957.

to about half the present population of the United States. The capital and the organizing effort that will be absorbed merely in the effort to provide tools, houses, schools, and other facilities, as well as food and clothing, for this many more people is staggering. It makes the eagerly sought goal of raising incomes to acceptable modern levels a much more distant one, if such a goal is attainable at all without checking population growth.

If strenuous efforts to achieve economic and social advancement result in little more growth in production than is necessary to keep up with population growth, the frustration of hopes will create a poor climate for democratic government. Also, internal pressures have a way of encouraging external aggression. Population pressure was not the sole cause of Japanese military aggression in the Pacific, but it was one factor; it certainly supplied an excellent argument to the expansionists who wanted to build a Japanese "co-prosperity sphere."

B. LONG-TERM IMPLICATIONS OF WORLD POPULATION EXPLOSION

The long-term implications of these rates of growth are evident. The population-carrying capacity of the world is not infinite. Some workers have studied, in the light of existing knowledge, what the population capacity of the earth might be. Estimates vary widely. Some prepared several decades ago set the maximum world population at less than 3 billion, assuming a minimum food standard. More recent studies go as high as 5 to 17 billion. A 1952 study concluded:

> The area of the world at present cultivated could support, if fully farmed by best known methods, at least 3 billion people on an adequate nutritional standard. If the lands at present unused or inadequately used could be brought into production on the same basis, potential world population climbs over 10 billion.[16]

[16] L. D. Stamp, as quoted more extensively by W. S. Woytinsky, "World Resources in Relation to Population," in Philip M. Hauser (edition), "Population and World Politics," Glencoe, Ill., The Free Press, 1958, p. 59.

TABLE II. ESTIMATED POPULATION, AND POPULATION PROJECTED BY THE MEDIUM ASSUMPTION, OF CONTINENTS AND THE WORLD, 1900, 1925, 1950, 1975, AND 2000
(Millions)

Year	World [1]	Africa	Northern America [2]	Latin America [3]	Asia [4]	Europe, including U.S.S.R.	Oceania
1900	1,550	120	81	63	857	423	6
1925	1,907	147	126	99	1,020	505	10
1950	2,497	199	168	163	1,380	574	13
1975	3,828	303	240	303	2,210	751	21
2000	6,267	517	312	592	3,870	947	29

[1] Sum of figures rounded to the nearest million.
[2] America north of Mexico.
[3] America south of the United States.
[4] Excluding the Asiatic part of the U.S.S.R.
Source: "The Future Growth of World Population," United Nations Department of Economic and Social Affairs, New York, 1958, p. 23.

New advances in the sciences and technologies affecting food supply could modify these estimates, but as the authors of the United Nations studies point out, the disturbing fact is that a jump to a world population of 7 billion could take place in less than 40 years. To achieve what the 1952 study suggests would undoubtedly require a level of international cooperation and determination, a level of specialization and industry, and a level of investment for which there is no historical precedent on anything approaching this scale.

In another recent study it is estimated that to feed between 4 billion or 5 billion people on an adequate diet would require a level of agricultural productivity almost twice the present world average, which would probably take 30 to 50 years to achieve. This study concludes that to achieve this increase would require a worldwide conscious effort and substantial increases in present levels of international aid. In fact, to bring about this increase in food production would be a major financial task, estimated speculatively by these authors at $500 billion, or between $10 billion and $15 billion a year.[17]

About two-thirds of the present world population is not well nourished; to achieve higher standards of nutrition and to feed the forecast numbers of people could require an annual increase of 2.25 percent in world food production.[18] Long-term experience to date shows that the United States has only achieved a comparable rate of increase during the period of 1934-38 to 1950-55 when the tremendous scientific and technological resources of the Nation were fully marshaled into the effort. During the same period, world food production only increased by about 0.9 percent per year.[19] In fact, in many parts of the world, food production has not kept up with population growth. In these areas people are even less well fed today than they were 20 years ago. Statistics are a dry measure of human suffering, but in Asia (excluding mainland China) per capita food production in 1957-58 was 10 percent lower than it was in 1934-38. In Latin America it was 3 percent lower, and in the world as a whole it was only 1 percent higher during the same period.[20]

Such facts have led to many pessimistic discussions of the actual long-term possibilities of achieving

[17] Harrison Brown, James Bonner, and John Weir, "The Next Hundred Years," New York, Viking Press, 1957, pp. 66-67.

[18] This estimate was prepared by Political and Economic Planning (PEP) on the basis of earlier and lower United Nations population forecasts. See "World Population and Resources," a report by PEP, London, Allen and Unwin, 1955, p. xvii.

[19] Ibid., p. 46. On the other hand, in postwar years higher rates have been achieved in a number of regions, but these, to some extent, have reflected readjustment to the upheaval of the war and immediate postwar years.

[20] "The State of Food and Agriculture, 1958," Food and Agriculture Organization of the United Nations (FAO), Rome, 1958, p. 12.

higher levels of living in many countries of the world. Indeed, some students of the problem have reached the conclusion that population pressures are very likely to lead to violence and war.[21]

Food is the first item in a standard of living, but there are many other goods almost as essential to man in modern society. Goods and services that used to be luxuries—like shoes, educational opportunities, and medical services—are now necessities in the more highly developed countries and are rapidly becoming so in the less developed. Deprivation of these can perhaps cause more social and political disturbance than deprivation of food, since people chronically undernourished are likely to be apathetic. The discussion in the following pages relates to problems of increasing food production and of controlling population growth where needed. This discussion should be taken as a symbol of the broader problem—namely, the need to increase the per capita availability of standard-of-living goods and services of all kinds, including industrial as well as agricultural goods.

[21] See, for example, the conclusions of a number of studies conducted in 1958 at Technical Military Planning Operation (TEMPO)—General Electric, Santa Barbara, Calif. In the summary report, "1970: A Challenge to Planners," the authors, in discussing the world population explosion, state: "An inevitable result of the failure of the race to meet new demands from available resources will be continued change in relationships. Much of this change will be made by military rather than peaceful methods * * *. In furtherance of their cold war aims the Communist governments of Russia and China will try continuously to exploit these conflicts" (R-58TMP-100, p. v).

C. A FIRST LINE OF ATTACK: INCREASING WORLD SUPPLIES OF FOOD

Can science and technology help relieve the deficiencies in food production? The answer is "Yes." But the answer has been "Yes" for more than 100 years; during this period, food surpluses in some areas have been matched by widespread famines elsewhere. We should not expect any miracle from future scientific advances in food production. In fact, it is difficult to evaluate the impact of science on world food productivity because it is dependent on innumerable factors, including, among many others, what national and international policies are adopted to foster the transmission and adaptation of scientific advances to underdeveloped countries.

1. Cultural and ideological problems

Probably one of the most significant advances in food production, the introduction of artificial fertilizers (as opposed to natural manures and composted organic wastes) dates from the studies and demonstrations undertaken by J. B. Lawes in England in 1843.[22] Yet 100 years later, average per acre

[22] He founded the Rothamsted Experimental Station, Harpenden, Herts, England, one of the world's leading centers of agricultural research.

fertilizer consumption in India was still only about 1 percent of European average consumption of fertilizer.

The problem of increasing world agricultural productivity is therefore not only a problem in the physical or biological sciences and technologies. The challenge really consists in finding ways to diffuse scientific and technological advances to the countries where food production most needs to be stepped up. This requires new breakthroughs in the theories and techniques of communication—not so much in the physical aspects of communication, though this may help, as in its social aspects—and in the social sciences and technologies dealing with customs, laws, accumulation of capital, management, land tenure, religious beliefs, etc. Prospects for advances of this sort are considered in other chapters.

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2. *Avenues of science: Selected examples*

What can be done to extend acreage, to use better plants and animals, to reduce disease and pest damage, to reduce waste, to find new or synthetic foods, and perhaps to achieve radical new methods of food production through better understanding of the process of photosynthesis? These are by no means all the avenues open to science, but these examples indicate the possibilities of the future.[23]

[23] For example, soil conservation is not covered in this report. Yet this should be a matter of grave concern, as each year the world loses substantial areas as a result of overgrazing, poor farming techniques, erosion, soil exhaustion, increased salinity, etc. Scientific and technological advances in this field have been substantial, but diffusion, even in the United States, has been slow.

Extending food acreage

Control of human and animal disease in certain areas.—In those areas where the tsetse fly now prevents effective use of much good land, successful experiments with large-scale breeding of irradiated sterile male flies open challenging new avenues to control in future years. Various means are or will be available to wipe out malaria, hookworm, dysentery, and other tropical diseases.[24]

Displacement of certain industrial or flavor crops.—In another part of this report we examine technological developments which may replace such crops as cotton, rubber, coffee, tea. These replacements could open substantial land

[24] The World Health Organization of the United Nations, various universities, research establishments, government agencies and foundations in the United States and Europe, and governments of numerous underdeveloped countries are making striking progress against tropical diseases, notably malaria and schistosomiasis. Malaria, for example, is being controlled by a multiple attack. Insecticides, already well known, are being used; new antimalarial drugs (such as chloroquin) are being found increasingly effective, and new techniques for administration are making them effective over longer periods of time. Drugs such as pentachloraphenol are being used to treat water, and thus eradicate the schistosoma worm causing schistosomiasis. New techniques and materials are also being used against various nutritional diseases throughout the world, such as the kwashiorkor disease of Africa, a children's nutritional disease similar to pellagra.

areas for other purposes, including food production.

Breakthrough in increasing availability of irrigation water.—Extending acreage depends in many instances on the possibility of finding or developing new sources of irrigation water. The Sudan was able to utilize much arid land when Nile water was pumped to the surrounding plateau, and in recent years we have become aware in the United States of the increasing importance of irrigation water in our Southwest. There are many research approaches to water conservation:

Control of evaporation.—Recent experiments indicate that thin (monomolecular) layers of cetyl alcohol on reservoirs can reduce surface evaporation by as much as 50 percent.

Reclaimed sewage. — Modern treatment plants can provide waste water at low costs, and already a number of U.S. industries are using such supplies.

Saline conversion. — Progress in this field has been relatively hopeful in recent years, although the amount of research being done is not very large.[25] The Office of Saline Water in the U.S. Department of the Interior has sponsored a research program involving expenditure of about $500,000 annually, and it recently announced a $10 million program for building experimental plants. The goal of this program is water at $1 per 1,000 gallons. While this cost is still too high for most irrigation uses, it would prove economic for certain industrial and domestic demands. It would appear that a breakthrough in this field could have repercussions in arid parts of the world. Areas that would benefit include parts of Egypt, Iraq, India, Pakistan, Ceylon, Peru, Mexico, Greece, Italy, Spain, and much of North Africa, not to mention our own Southwest.[26]

Farming the ocean.—New fishing techniques, such as the recently developed efficient electrical methods of concentrating and killing fish, show great promise, particularly in large factory-type operations. Concurrent advances in fundamental studies could result in better techniques to locate and identify fisheries, and in techniques to maintain, protect, and enlarge their size and reproductive capacities.

Open sea (pelagic) fisheries, primarily for tuna, today account for only a small percentage of total catches. Many of these have been developed recently, and active exploration is continuing. The potential of these fisheries is probably considerable, as indicated by the abundance of large fish and mammals (for example, whales and squid) that in certain regions live off the smaller inhabitants of the

[25] See "Fresh Water From the Sea," Studies in Business and Economics, Bureau of Business and Economic Research, University of Maryland, Vol. 12, No. 3 (December 1958).

[26] No worldwide study has been made of the potential implications of such a breakthrough. For what uses is water economical at various levels of cost? What areas can be opened up at varying costs of irrigation water, and how much new land might thus be made usable?

sea. This is an area where fundamental knowledge is sorely lacking.[27] Pelagic fishing should increase significantly in the next decade, and the increase will depend on the amount of research that can be devoted to this effort.[28]

Using better plants and animals

The past achievements of plant and animal breeders and geneticists in raising the efficiency of agriculture are well known. New startling developments in this area could take place in coming years. This is particularly true if an increased effort were undertaken to develop plants and animals particularly suited to areas of the world where the modern use of genetics has not yet had a sufficient impact. . . .

* * *

Plant disease and pest control

For many years researchers have attempted to control various agricultural diseases through use of organisms harmless to plants. There have been many notable successes: Black scale, a damaging citrus pest, was controlled with the insect *Metaphyscus helvolus;* mealybug pests were controlled with an Australian lady beetle; more recently, a virus has been used to control the alfalfa caterpillar.

In recent years, researchers have been turning more and more to bacterial, fungal, and viral controls. It is expected that major advances in the field of biocontrol will come through use of these microorganisms although there is still much to be done using larger organisms.

The great economic effect of biocontrol of diseases can be seen from one recent example: several years ago vast tracts of Canadian forests were sprayed with several different viruses from airplanes. The spruce budworm, pine sawflies, and several other devastating insect diseases were all but eradicated. Perhaps even more important, the control is expected to last over many years.

* * *

Food habits and nutrition

In many areas prevalent food habits militate against adequate

[27] In recent years there has been much literature on the possibilities of building mechanical whales to filter and harvest plankton for human consumption. Graham has suggested we concentrate on the herring, which eat plankton and are easier to catch and consume. (See Michael Graham, "Harvest of the Seas," background paper No. 24, Wenner Gren Foundation International Symposium, "Man's Role in Changing the Face of the Earth," Princeton, 1955.) Other workers in the field have shown the possibilities of plankton, and the Rockefeller Foundation has been supporting basic research in the field at various centers of oceanographic research (see F. G. Walton Smith and Henry Chapin, "The Sun, the Sea, and Tomorrow," New York, 1954). There have also been some speculations on the possibility of using atomic energy to create an upwelling current in barren areas of the sea where no such current exists and where phosphates and other nutrients are correspondingly insufficient for sea life.

[28] Recent friction between the Russians and Canadians regarding the timing of the tuna fishing season could have been more effectively discussed and negotiated if there existed a better understanding of the mating habits of tuna. Conservation measures were recognized by the 1958 Conference on the Law of the High Seas that established the first manual of international cooperation for this purpose.

diets. As one author points out:[30]

> Manioc [cassava] is a remarkable crop with high caloric yield per acre. Manioc is easy to cultivate, stores well, and is resistant to drought and to plagues such as the locusts.

He goes on to add that the production of manioc is second to that of rice in many countries.

> But from the nutritional standpoint it poses many problems. Manioc has a very low concentration of protein of low quality. Thus the occurrence of kwashiorkor[31] often seems to follow the pattern of manioc production. In many societies there exist customs, taboos that also restrain the use of available foods. In parts of Uganda, milk is thought to spread leprosy, and in many parts of the world one finds taboos related to religious, fertility, or virility rites that prohibit the consumption of foods that might complement inadequate diets.

Education is the key to improving nutritional practices. To educate people successfully for better food habits requires a good understanding of the reasons for present food habits, factors in the cultural environment related to these habits, the potential impact of suggested changes, and the means of communication needed to reach the people effectively.[32]

New sources of food, natural or synthetic

Proteins.—Proteins are present in most of the higher plants. The cereal grains contain 8 to 15 percent protein, the potatoes 4 to 8 percent, and the legumes as much as 25 to 45 percent. Except for the legumes, which are already an important source of protein in such countries as Japan, protein in other plants is not sufficiently concentrated to provide an adequate protein diet or it is sometimes not assimilable by humans. The meat-eating countries solve the problem mostly by having animals assimilate the vegetable protein for man. While this approach is rewarding to taste, it is expensive, since the animal is an inefficient converter. Grazing provides 10 times less protein per acre than soybeans do. For those areas where protein is scarce, it is useful to examine other possible approaches.

* * *

Food synthetics. — Will science provide means to synthesize some of the basic components of human food, thus possibly greatly reducing the cost of producing food? Already limited forms of chemical food synthesis provide complementary food sources. For example, most of the vitamins are now being produced synthetically, and synthetic amino acids may soon be more generally used as food supplements. The cost of synthetic amino acids is still high, although showing possibility of continued reductions. Lysine, which cost $12 per pound in 1955, came down to slightly less than $6 early in 1959. Some industry spokesmen have predicted costs below $2 per pound by 1962-64.[36] . . .

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[30] J. M. Hundley, "Nutrition Problems Associated With Food Habits and Environment," in "Proceedings of the Borden Centennial Symposium on Nutrition," New York, 1958, p. 3.

[31] A nutritional disease of children in Africa, similar to pellagra.

[32] See J. Cassel, "Social and Cultural Implications of Food and Food Habits," American Journal of Public Health, Vol. 47 (1957), pp. 732-740.

[36] See Chemical and Engineering News, April 20, 1959, p. 25.

A possible breakthrough: Photosynthesis.—Advances in our understanding of the processes of photosynthesis[37] itself could have tremendous international implications. Man might be able to develop synthetic plants far more efficient than natural plants. If improvements of the order of 10 or 100 times were achieved, the over-all social cost of providing food to mankind could be greatly reduced. While such a development may not be so important to those countries that have already achieved high levels of agricultural productivity, it could mean new opportunities to underdeveloped countries, new opportunities to devote a more substantial part of their manpower to the task of industrial development. . . .

* * *

Temporary measures

The Food and Agriculture Organization of the United Nations has studied the feasibility of establishing within the framework of the United Nations a world food reserve to help relieve famines and shortages and to counteract excessive price fluctuations.[38] Senate Resolution 85[39] in 1955 proposed that the United States negotiate for the creation of a world food bank. No concrete developments have followed these proposals, but the United States has participated in the creation of a five-nation committee to consider joint measures for disposal of wheat surpluses without disturbing international commercial markets.[40] American food surpluses could probably be used more effectively to achieve the foreign policy objectives of the Nation if their handling was specifically planned as an instrument for promoting development.[41]

In this context, the Chinese Communist claims of increased food production bear watching. If the Chinese can achieve substantial surpluses, as they claim they will, China could not only enter the international market but achieve a psychological victory that would undoubtedly have important political consequences.

Science and technology can provide sufficient food for the existing world population, and presumably for some increases in population, although for each level of world science and technology there is a maximum population that can be fed. Food surpluses can be used as a temporary measure to provide the time necessary to diffuse modern scientific knowledge and technology to the less productive coun-

[37] Photosynthesis is the natural synthesis which produces carbohydrates and oxygen from carbon dioxide and water under sunlight.

[38] See "Functions of a World Food Reserve—Scope and Limitations," FAO, Rome, 1956, and "National Food Reserve Policies in Underdeveloped Countries," FAO, Rome, 1958.

[39] 84th Cong., 1st sess., S. Res. 85, Washington, March 1955.

[40] (New York Times,) May 6, 1959.

[41] See the recent National Planning Association report recommending that the present surplus disposal program be revamped as a food for development program, which could be looked upon as a part of the Nation's foreign aid program rather than a disposal operation. "Farm Surpluses and Foreign Aid," National Planning Association, Washington, July 1959.

tries and to increase agricultural productivity still further. Research can be pushed in directions that may lead to unconventional methods of food production. Such a program requires new advances in many fields of science, capped by progress in the sciences and techniques that relate to diffusion and social adaptation, to permit effective communication between those who have science and technology and those who need it. This is an area where the United States is in a position to exert leadership.

D. A SECOND LINE OF ATTACK: POPULATION CONTROL

In certain parts of the world, population control is already a necessity. This is true in Japan, Java, Barbados, Puerto Rico, and Mauritius, all of which are overpopulated islands. It is true in Egypt, India, and China, already densely populated. It is to some degree true in many other underdeveloped countries where the task of achieving higher levels of living in the face of rapid population increase requires substantial effort and capital investment just to stand still. We all remember the words of the Queen to Alice:

> Now here, you see, it takes all the running you can do to keep in the same place. If you want to get somewhere else you must run at least twice as fast as that.

Population pressures have already led certain nations to initiate national birth-control programs. Having to select between an ultimate increase in the death rate, or a reduction in birth rates, these Governments have selected the second alternative. Puerto Rico as early as 1938, Japan in 1949, and India in 1951 instituted birth-control programs.[42]

These efforts have used what can be defined as the conventional birth-control technology (abortion clinics, sterilization, education in use of conventional contraceptive methods, etc.).[43] Japan was able between 1948 and 1956 to reduce the birth rate from 33.7 per 1,000 population to 18.5, while Puerto

[42] Communist China a few years ago launched a birth-control campaign, though subsequently this campaign appears to have been soft-pedaled; the ideological position is apparently still the one maintained by orthodox Communists; namely, that under socialism, production is so efficient that population growth presents no problem.

[43] Modern methods of contraception appear to have come into fairly widespread use in Europe and America in the first half of the 19th century, but their most rapid spread was after 1877. In that year Charles Bradlaugh and Mrs. Annie Besant were tried in an English court for selling a pamphlet originally issued in 1832 by an American physician, Dr. Charles Knowlton, "The Fruits of Philosophy; or, the Private Companion of Young Married People." The wide publicity of the trial enormously increased the sale of this and similar tracts, and stimulated an extraordinary demand for contraceptives. The Malthusian League, which aimed to combat poverty by encouraging birth control, was formed in England in the year of the trial, and similar organizations appeared in many countries in the next few decades. The arrest in 1914 at New York of a public nurse, Margaret Sanger, and later of her husband, for distributing her pamphlet on family limitation gave publicity to the issue in the United States, and the National Birth Control League dates from 1914-15. Mrs. Sanger toured the world early in the 1920's, arousing considerable discussion in countries such as Japan, China, and India.

Rico was able to reduce it from 42.4 in 1947 to 34 in 1956.[44] The Indian program is too small and too recent to have yet brought results.

1. Cultural and ideological problems

The problem of achieving effective birth control depends on cultural or ideological attitudes and on the availability of technical means.

The effectiveness of the Japanese birth-control program has been based on the widespread use of abortion clinics. This effectiveness reflects the fact that abortion is culturally acceptable to Japanese society, that Japan has the trained medical profession to establish such clinics, and that the geographical and population dispersion problems in Japan are not insurmountable. Yet abortion clinics are not the answer in many other countries, particularly those where abortion is not acceptable for cultural and religious reasons, and those that do not have the medical facilities needed. In Puerto Rico, sterilization has been widely used, but sterilization is costly, requires medical sophistication, and its effects cannot easily be undone. Other conventional approaches that have been tested have usually not been successful, particularly in the areas where poor and uneducated people must be reached.

The worldwide consequences of the population problem are greatly complicated by the diverging cultural, ideological, and religious attitudes in many countries. In fact, as pointed out in a recent issue of the United Nations *Population Bulletin*,[45] any multilateral approach to population problems has not been possible within the United Nations because of a "three-way split in thinking concerning policy formulation" between the Communist countries, the predominantly Roman Catholic countries, and those countries where Victorian taboos make the subject matter undesirable political or social publicity.

But if we disregard for a moment the cultural and ideological problems, what of the possibility of more effective technical means for birth control? This could be highly significant, particularly in countries with low literacy and difficult communications problems.

2. Avenues of science

Many scientists concerned with these problems believe that an inexpensive, easily used contraceptive with limited time effect and no adverse health effects could provide the means for effectively controlling population growth in those countries where national birth-control policies are adopted.

The most promising approach at present is the development of an oral contraceptive for women, based on the ovulation-inhibiting effects of certain steroids.[46] The 1956-57

[44] The decline in the birth rate in Puerto Rico is also due in part to heavy migration, which probably reduced the number of women of child-bearing age.

[45] Population Bulletin, New York, United Nations, March 1959, p. 34.

Note: Erroneously attributed to the United Nations instead of to the Population Reference Bureau.—Editor.

[46] There are several possible research approaches to birth control. First, either the male or female may offer control

Puerto Rico tests undertaken jointly by the Worcester Foundation for Experimental Biology of Worcester, Mass., and the Family Planning Association of Puerto Rico showed that in a sample of 265 married women from a low income development project, 100 percent birth control was achieved as long as medication was kept up (i.e., taking one tablet a day during most of the menstrual cycle). Nevertheless, during the 16 months of investigation, 19 pregnancies took place, 5 of which were in women having omitted 3 to 17 tablets from the advised regimen, and 14 in individuals who had stopped medication because of reactions or "carelessness." Even with this limitation, the tests were apparently a definite success.[47] To date no serious ill effects had been suffered by the participants. Following this, Dr. Gregory Pincus, head of the Worcester Foundation, was to initiate a second test in 1959 in Bombay State in India.

The present limiting factors of this oral contraceptive are the relatively high costs of the tablets (amounting to $11 a month, although there might be appreciable reduction if mass produced), and the fact that the requirements of one tablet a day are to some extent more exacting than other conventional techniques.

Some other compounds have been tested on animals, and these tests have indicated other possible approaches. For example, some of these compounds can cause the reabsorption of the fertilized ova in rats and dogs;[48] others act in ways similar to the steroids.

It is doubtful that birth-control compounds could be widely applicable in Catholic countries, particularly any compound that controls birth after the beginning of pregnancy. On the other hand, in those cultural milieus where abortion is acceptable (particularly China and Japan) these latter compounds should permit (once developed) much more effective, less dangerous, and less expensive birth-control programs.

Since the Catholic Church does approve, to a limited extent, of the rhythm method,[49] some searchers have sought to devise techniques that would at least permit clear definition of monthly fertile periods. For example, it would seem reasonable that an efficient rhythm birth control might be provided by a compound that would cause a slight ill effect during the short

mechanisms. With the female cycle, it is possible to control birth before conception and after conception. The research done to date has mostly been on the female cycle, and mostly on preconception controls, although interesting results have recently been published on postconception controls.

[47] Gregory Pincus, John Rock, Celso-Ramon Garcia, Edris Rice Wray, Manuel Paniagua, Iris Rodriguez, "Fertility Control With Oral Medication," American Journal of Obstetrics and Gynecology, Vol. 75 (June 1958), pp. 1333-1346.

[48] See, for example, S. J. Segal and W. O. Nelson, "An Orally Active Compound with Antifertility Effects in Rats," in "Proceedings of the Society for Experimental Biology and Medicine," Vol. 98 (1958), pp. 431-436.

[49] The Church approves of the rhythm method when medical, eugenic, economic, or social reasons require birth control.

monthly fertile period, making marital relations at least undesirable. Such a compound has yet to be found, although workers have reported tests that permit identification of the fertile period.[50]

E. ISSUES FOR AMERICAN POLICY

World hunger and population control present major long-term international policy problems to the United States and to the other nations of the world.

In a finite world some means of controlling population growth are inescapable. The traditional means have been disease, famine, and war. If other means are to be substituted, conscious national and international policies will be required.

Population pressures can become significant causes of social unrest and war. In certain parts of the world overpopulation is already prevalent, and new approaches to the problem are urgently required. While some $30 billion are spent each year on the worldwide attack on mortality, only a few mililon dollars are allocated to programs which affect birth rates.[51] A possible approach would be for the U.S. Government to study (with the governments of other nations, through the United Nations, or bilaterally) the possibility of providing research funds to certain foreign agencies and laboratories (for example, in Japan and in India) for the large-scale human testing of devices, which is so necessary but difficult to conduct without adequate cooperation and funds. In this way those governments and peoples that feel the problem to be acute would be enabled to speed up their quest for the physical, biological, and social knowledge needed to check population growth by means other than disease, famine, and war.

[50] For a broad discussion of social and biological problems of population control, see Richard L. Meier, "Modern Science and the Human Fertility Problem," New York, 1959. Recent scientific developments as of the end of 1958 are described on pp. 248-250.

[51] Population Bulletin, op. cit., p. 35.

POLICY STATEMENT ON THE POPULATION PROBLEM

Approved by the Governing Council of the American Public Health Association on October 21, 1959

There is today an increase of population which threatens the health and well-being of many millions of people. In many areas of the world substantial population increase means malnutrition and outright starvation. In other areas it may mean increased stress in family life, reduction of educational opportunity and the retardation of the industrial development on which a nation's rising standard of living

depends. No problem—whether it be housing, education, food supply, recreation, communication, medical care—can be effectively solved today if tomorrow's population increases out of proportion to the resources available to meet those problems.

The patterns of family life directly affect human health and individual capacities. Serious public health problems are posed when family size impairs ability to sustain a healthful way of life, when childbearing may affect adversely the health of the mother and her offspring, when the cultural and spiritual aspirations of the family are frustrated by sterility.

The interplay of the biological, ecologic, cultural, and economic factors that operate to produce population change is not adequately understood. Especially lacking is scientific knowledge concerning human fertility. However, the healthful effects of family planning and spacing of births have been recognized by leaders of all major religious groups, as well as by leaders in medicine, welfare, and public affairs. Several methods are now available for the regulation of conception, one or another of which may be selected as medically appropriate, as economically feasible, as consistent with the creed and mores of the family concerned.

The public health profession has long taken leadership in defeating disease, disability and death. It must now assume equal leadership in understanding public health implications of population imbalance and in taking appropriate action.

The American Public Health Association, retaining cognizance of the principle of religious freedom by all religious groups as expressed, for example, in the First Amendment of the Constitution of the United States, believes therefore that:

1. Public health organizations at all levels of government should give increased attention to the impact of population change on health.
2. Scientific research should be greatly expanded on (a) all aspects of human fertility; and (b) the interplay of biological, psychological and socio-economic factors influencing population change.
3. Public and private programs concerned with population growth and family size should be integral parts of the health program and should include medical advice and services which are acceptable to the individuals concerned.
4. Full freedom should be extended to all population groups for the selection and use of such methods for the regulation of family size as are consistent with the creed and mores of the individuals concerned.

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